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ABSTRACT

While there is increasing evidence that creativity can be improved through training, the spacing of the training has not been studied. This study assessed the effect of spaced training on the use of creative imagination in 110 undergraduate students. The research design was a randomized delayed posttest-only design. The independent variable was spaced training in creative imagination and the dependent variable was Thinking Creatively With Sounds and Words, Form IIA, a measure of verbal originality that relates to imagination, imagery, analogy, and that helps listeners use their creative imagination to produce original verbal images. Subjects in the treatment condition received a 240-minute training program designed to facilitate the use of the creative imagination. Treatment subjects were trained with exercises in breaking away from the obvious and commonplace, synthesis, analogy, restructuring, and incubation. The results indicated no significant main effects for the training condition, suggesting that the time between the training and the testing may have been too long to observe treatment effects. (Author/NB)

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Effects of Spaced Training in Creative Imagination and Delayed Posttesting on Originality

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Abstract

This study assessed the effect of spaced training to use the creative imagination in 110 undergraduates. The research design was a randomized delayed posttest-only design. The dependent measure was Thinking Creatively with Sounds and Words. Individuals in the treatment condition received a 200-min training program designed to facilitate the use of the creative imagination. The results indicated no significant main effects for the training condition which suggested that the time between the training and testing may have been too long to observe treatment effects.

Effects of Spaced Training and Delayed Posttesting on Stimulation of Creative Imagination

In 1950 J. P. Guilford presented his ideas on creativity in his presidential address to the American Psychological Association. Since then study of the effects of creativity training programs has become increasingly popular. At one time it was believed that creative production could only be left to chance. However, today there is increasing evidence that creativity can be improved through training (Rose & Lin, 1984; Torrance, 1972). It is evident that creativity can be increased in children and adults through training, but the spacing of this training has not been studied.

Creative Imagination

Creative imagination has been defined by Khatena (1982) as mental processing where intellectual and emotive forces participate in the propagation, stimulation, and energizing of creative acts. In other words, creative imagination is the use of imagery and the imagination to be creative. Imagination has been used in many different areas to create. Khatena (1982) used examples such as the development of the creative works of Shakespeare, William Blake, Wordsworth, and Samuel T. Coleridge. The use of imagination has been cited as a vehicle to creative production. These creative individuals used imagination as a force or power to put their creative energies to work.

Khatena (1984) outlined a model of creative imagination, the Multidimensional Interactive Creative Imagination Imagery model (MICII) which has three components individual, environment and cosmic. In the MICII model, creativity is viewed as a complex process where many factors interact.

The individual component of the MICII model is concerned with everything that makes up a person. This component includes psychological and physiological elements. Information on images that reach the brain are coded into symbolic or language form. This information is available for processing similar to assimilation and accommodation as described by Piaget.

The individual dimension has three divisions: intellectual processing, levels of awareness, and development. Khatena (1984) used Guilford's (1967) Structure of the Intellect to explain intellectual processing. Levels of awareness includes the conscious, preconscious, and unconscious as Freud discussed. Gowan (1972) indicated that the preconscious is the source of creativity: when we learn to master the preconscious we can use it to produce creative ideas. Arieti (1976) also believes the preconscious is where the amorphous cognitions that occur without representation are transformed into such things as images that can lead to creativity. The individual component of the MICII model relates to creative and intellectual development that is a result of growth and changes associated with systems, models, or developmental stages.

Environment means all the stimuli which travel as images through neurons that an individual encounters. These stimuli may be received by the senses in sociocultural situations. The environmental factor is developmental because it is spread over time.

Cosmic is the most controversial part of this model because objective verification is not possible (Khatena, 1984). Cosmic is

regarded as original creative life force, the grand source of all creativity. The cosmic can be described as the influence of the creator, a form of spiritual energy, and an inspiration from God or cosmic energy.

These three dimensions, individual, environmental, and cosmic are interactive. A person can range from very high to very low on the individual dimension and have a wide range of exposure to environmental variables. The individual-environmental ranges can form many interactions from both positive to both negative or there can be a variety of combinations between the two extremes.

There are many other views of creative imagination. For example, Eccles (1958/1972) believes creative imagination involves brain activity where synaptic connections form and maintain memory patterns. The brain must have the ability to continually combine and recombine patterns in unique ways.

Eccles (1958/1972) sees creative imagination as "the most profound of human activities . . . that gives new insight or understanding" (p. 39). Eccles believes creative activity is flashed from the subconscious mind to consciousness. In order for this to happen there must be a wealth and subtlety of stored memories and critical evaluations, a great deal of expert knowledge, and a failure in the syntheses of engrams or a conflict in the interrelationship of engrams that demands a solution. For individuals to use their creative imagination, the brain must have an adequate number of neurons with many synaptic connections among the neurons. The brain also needs the structural basis for a large range of patterns of activity, the synapses in the brain should be able to increase their function as a function with usage, and the

spatio-temporal patterns of the brain's engrams must be able to produce novel and interacting forms.

Jaynes (1976) states that creative imagination is a right cerebral hemisphere activity in the Wernicke area of the brain. The traditional ideas of right hemisphere activity (Sperry, 1974) also make creative imagination a right brain activity. Gerard (cited in Ghiselin, 1952) also sees creative imagination in terms of brain activity. He believes neuron activity after sensory messages are received by the cortex leads to a continuous, complex mental activity which is responsible for ideas and thinking. However, Rugg's (1963) view of creative imagination is the ability of the mind to formulate concepts beyond those conceptualized from external objects.

Training in Creativity

Considerable research on the stimulation of creativity exists. While there are various techniques and materials used, most of the research is based on the idea that through practice or training creative thinking can be improved. Three papers have attempted to summarize the research in this area.

Torrance (1972) reviewed 142 studies which attempted to teach children to think creatively. The studies were chosen because they involved quantification and presentation of evidence. Of the 142 studies, 103 used the Torrance Tests of Creative Thinking as the performance measure. Torrance divided the studies into nine categories according to the techniques used. From the data he concluded that it is possible to teach children to think creatively. In addition, Torrance concluded the Osborn-Parnes (Osborn, 1963;

Parnes, 1967) program had the highest percentages of success and that the most profitable approaches involved cognitive as well as emotional functioning, provided enough motivation and structure, involved interaction between children and teachers, but the greatest and most predictable results are from training procedures that employed deliberate teaching.

A meta-analyses of 46 studies of creativity training was completed by Rose and Lin (1984). Rose and Lin chose only studies that used the Torrance Tests of Creative Thinking and that employed a series of lessons or training as treatments. The studies were divided into six groups. Results indicated an overall small mean effect size (.468). Some kinds of creativity training had larger effect size on dependent measures such as verbal originality (.693). The authors concluded the most consistent impact on creativity was produced by the Osborn-Parnes Creative Problem Solving Program (Osborn, 1963; Parnes, 1967). General conclusions by Rose and Lin were that creativity is a skill that can be stimulated and nourished through teaching.

A critique and summary of research on creativity training (Mansfield, Busse, & Krepelka, 1978) indicated acceptance of the high level of success of these studies is premature since there are conceptual and methodological problems with the research. Some of the major problems include differentiating long-term from short-term effects that are due to changes in response set and motivation, use of tests that may be influenced by persistence and understanding what kinds of answers are scored higher, lack of random assignment to control and training conditions, lack of control for Hawthorne effects, use of small samples, use of program tasks that are very

similar to the criterion tests, use of individual scores rather than classroom means in statistical analysis, and use of univariate rather than multivariate analyses. The authors reviewed articles in six major areas of training and concluded that the evidence indicates that creativity can be trained. However, Mansfield et al. (1978) complained that there is limited and inconsistent evidence that the treatment effects transfer to other types of problems different from the dependent measures.

In conclusion, considerable data indicate creativity can be improved through deliberate training and there have been some methodological problems noted in some of the research. The Osborn-Parnes programs seem most effective, and the data indicate a large effect size for verbal originality.

Studies of training creative imagination.

Since Richardson's (1969) claim that only two studies investigated the creative correlates of imagination imagery, a number of studies have been completed that studied creativity under imagination imagery conditions (see Khatena, 1984). That creativity can be improved through training has gained wide acceptance and has been widely studied using a number of methods and dependent measures (Parnes, Noller, & Biondi, 1977; Torrance, 1972), yet there are relatively few studies that train individuals to use the imagination to produce original verbal images (Khatena, 1984).

Past research on the stimulation of creative imagination has been reviewed by Khatena (in press). Below is a summary of these studies. To study the effects of preparation (exercises involving imaging which precedes incubation and creative imaging) and incubation (relaxation during the interval following preparation which fosters imagery) on verbal originality, Parrish (1981)

utilized Khatena (1981). Seventy-two college students were randomly assigned to one of four groups. The four groups were: full preparation and full incubation; full preparation and no incubation; no preparation and full incubation; and no preparation and no incubation. Training and posttesting were completed on 1 day. The design was a posttest-only 2 x 2 factorial design. The posttest measure was Onomatopoeia and Images (Khatena & Torrance, 1973). Results indicated that creative imagination was increased with incubation only when not preceded by preparation, and verbal originality was not enhanced when first preparation, then incubation was administered to subjects. Parrish (1981) concluded the training program of Khatena (1981) was helpful to improve originality.

Khatena and Parnes (1974) studied the effects of a two semester creative studies program on verbal originality with a posttest-only design. Eighty-eight subjects were in the experimental group and 50 students were in the control group. Results indicated that the experimental group had significantly higher mean verbal originality scores on Onomatopoeia and Images, Form IIA (Khatena & Torrance, 1973).

A study to improve the production of original ideas (Khatena, 1970) used the Solomon four-group design (Campbell & Stanley, 1963) with 100 college students. Treatment consisted of: (a) breaking away from the obvious and commonplace; (b) transposition; (c) analogy; (d) restructuring, and (e) synthesis. The subjects received instruction and practice for 60 min the first day and further practice without instruction for 60 min the second day. Pretesting, training, and posttesting was completed in two days. Results indicated that training in these five areas increased the probability of original verbal responses to Thinking Creatively

with Sounds and Words (Khatena & Torrance, 1973) occurring.

A replication of Khatena's (1970) study (Khatena, 1971a) used 105 subjects and training which included the same five creative thinking strategies. In this study, the time was increased to 240 minutes (spread over a 4-day period) and a Solomon four-group design was used with Thinking Creatively with Sounds and Words as the dependent measure. Results indicated significant treatment effects for both tests of Thinking Creatively with Sounds and Words, and a significant interaction of pretesting and training only for Sounds and Images.

To further explore the effects of teaching creative thinking Khatena and Dickerson (1973) randomly assigned 59 sixth grade students to control and training conditions in a posttest-only design. The training group was exposed to 360 min of training (40 min each day for 9 days) which included breaking away from the commonplace, restructuring, and synthesis. Results indicated significantly higher mean differences on verbal fluency, flexibility and originality scores on the Torrance Tests of Creative Thinking, Verbal Form A. A significant interaction for originality was also found for the interaction of training by sex.

A study of training to use the creative imagination with 118 preschool children (Khatena, 1971b) used three creative thinking strategies breaking away from the obvious and commonplace, restructuring, and synthesis, in a Solomon four-group design. The subjects were taught 1 hour a day over a period of 6 days. Results of this study, using two figural forms of the Torrance Tests of Creative Thinking, indicated significant main effects for the experimental groups on fluency, flexibility, originality, and elaboration. In addition, there were significant

interactions for training and sex for fluency as well as for training and pretesting for elaboration.

Khatena (1977) studied the effect of training in creative imagination and analogy on original verbal images. Subjects were 100 college students divided into high or low groups based on scores of Something About Myself (SAM) (Khatena & Torrance, 1976). Training of the experimental group lasted 200 min (four 50-min sessions spread out over 10 days) which included use of images to produce analogies and the use of simile, metaphor, personification, and allusion to produce original verbal images. Results using Onomatopoeia and Images as the dependent measure indicated significantly higher mean verbal originality scores for both the high and low creative experimentals, but no significant increase in the use of personal, fantasy, or symbolic analogy.

To improve original verbal images using a training period of 400 minutes, Khatena and Barbour (1972) used the Solomon four-group design with 88 college students. Treatment consisted of three creative thinking strategies breaking away from the obivious and common place, restructuring, and synthesis as well as idea-spurring questions with rhythmic and melodic elements. Training lasted 400 min (50 min for 8 days). Results indicated significant improvement of original verbal images in the treatment group and a significant interaction of pretesting and training for Sounds and Images. These data support the use of creative thinking strategies with group brainstorming to encourage imaginative manipulation of rhythmic and melodic elements.

Khatena (1973) also studied the effects of the five thinking strategies between those with high and low creative self-perception as measured by SAM. Training lasted for 240 min spread over 4 days.

Results indicated there were significant main effects for training, but no significant differences between high and low creative groups after they received training to think creatively as measured by Onomatopoeia and Images (Khatena & Torrance, 1973).

From these studies it is clear training in the use of the creative imagination can produce significant improvements in creative thinking. However, all of the training programs except one (Khatena & Parnes, 1974) utilized a design that allowed for training on consecutive days with posttesting immediately after training. Research indicates spaced training is superior to masses training in learning and memory (Gartman & Johnson, 1972; Glenberg, 1976; Hintzman, 1969; Magigan, 1969), but what is the best method for training to use the creative imagination? The purpose of this study is to evaluate the effect of training known to improve verbal originality that is spaced with delayed posttesting.

Method

Procedure

The design used for this study was a randomized posttest-only design based on Campbell and Stanley (1963). The independent variable was spaced training in creative imagination (Khatena, 1979, 1984). The dependent variable was Thinking Creatively With Sounds and Words, Form IIA (Khatena & Torrance, 1973).

Treatment length was based on the effect size of past research on training to use the creative imagination. Effect size (ES) as discussed by Cohen (1977) is a measure of the strength of a treatment or the magnitude of the differences (standardized difference between group means) between control and experimental groups. The ES of the three studies that have used the same five strategies used in this study and that used Sounds and Images (SI) and Onomatopoeia and Images (OI) (Khatena & Torrance, 1973) were as

follows: Khatena (1970) with 2 hr of training was .98 for SI and .85 for OI; Khatena (1971a) with 4 hr of training was -.01 for SI and .78 for OI; Khatena (1973) with training of 4 hr was .87 for high creatives on ID and .95 for low creatives on ID. All of these studies gave the training on successive days with the posttests immediately after training. All of these values except -.01 are high which indicates large effect size. Based on these results, training of 4 hr was expected to be sufficient to observe significant mean differences between control and treatment groups.

The training given to the experimental group involved exercises designed by Khatena (1979, 1984) which included breaking away from the obvious and commonplace, synthesis, analogy, restructuring, and incubation. All subjects met for three sessions over 3 weeks (once a week for 2 hr for two consecutive weeks) and a 1 hour posttest. The posttest, Thinking Creatively with Sounds and Words (Khatena & Torrance, 1973) lasted about 1 hr and was given during the third session which was 1 week after the second training session. This schedule was adopted because it is closer to the schedule that might be given to an outside trainer or teacher who comes into a classroom or an industrial setting to complete training.

Materials

The subjects in the training group were trained with exercises in breaking away from the obvious and commonplace, synthesis, analogy, restructuring, and incubation which were designed by Khatena (1979, 1984). Training time given to each of the five strategies lasted 48 min.

1. "Breaking away from the obvious and commonplace requires a person to deliberately think in a way that is not habitual or

customary with an openness for the clever, unusual and novel" (Khatena, 1984, p. 203-204). Examples of the exercises were as follows: subjects were shown 12 semicircles and asked to look at each semicircle, image an object based on the semicircle, draw the images, and add details to the images. The same procedure was followed with 20 rectangles. The subjects were also asked to image sounds, like thunderstorm and surf, and then produce unusual responses to those sounds (Khatena, 1979).

2. Incubation involves the relaxation of conscious cognition which allows subliminal processes to operate (Gowan, 1978). Subjects were given imaginary situations, asked to develop images that relate to those situations, and then put the situations in the back of their mind and attend to other problems. Later, they returned to the situation and were asked to produce more images (Khatena, 1984). For example, subjects were asked to imagine that they had a time machine and they were to go forward in time to find a cure for cancer, but they had to decide what year to go to for the cure.

3. Analogies involve a comparison of the similarities between two objects which are not alike. Training in analogy defined and gave examples of analogies (direct, personal, symbolic, and fantasy) and then gave practice in the construction of the four types of analogies (Khatena, 1984). An example was to ask the subjects to make up a personal analogy which describes their body structure.

4. In restructuring, the subject is supposed to reorganize something. Subjects were shown pictures of a stick figure holding a balloon, a winter scene of a Buddhist Temple, and five geometric shapes. For each picture subjects were asked to look at the pictures, image the picture in their mind, choose elements of the picture, rearrange the elements using their imagination, and write

or draw elements of the images that are unique (Khatena, 1984).

5. Synthesis is organizing bits of information and objects into something unique (Khatena, 1984). Subjects looked at two pictures and a list of words and were asked to let the elements of the stimuli come together to create new meanings (Khatena, 1984). They also were given a short written passage, allowed to read it, create images of the words, and then organize the words into unique short phrases.

Subjects

One hundred sixteen subjects at a large southeastern university from introductory classes in psychology and educational psychology volunteered for the experiment. Of the 116 subjects, 110 (44 males, 66 females) completed the experiment. Mean age of the subjects was 20 years (*SD* = 3.5).

Measuring Instruments

Thinking Creatively with Sounds and Words, Form IIA (TCSW) (Khatena & Torrance, 1973) is a measure of verbal originality that relates to imagination, imagery, analogy and helps listeners use their creative imagination to produce original verbal images (Khatena, 1982). The rationale of TCSW is based on the operation of the creative imagination to break from the perceptual set of the test stimuli to restructure ideas, thoughts, and feelings in novel and meaningful associative bounds (Khatena & Torrance, 1973). TCSW is especially appropriate for a study of creative imagination because it stresses the legitimacy of divergent thinking, provides freedom from threat and evaluation, requires that the intellect interact with the emotions to emit an imaginative response, and it invites the subject to regress and break away from the usual to produce original responses (Khatena, 1978).

Sounds and Images (SI), one of the independent tests of TCSW was designed to measure original thinking and has two forms. The test has normative data on adults and on children from grades 3 to 12. Sounds and Images has individuals respond three times to a set of four sounds. Initially subjects are able to respond with their more common responses. Later, they can push their imagination further to produce unique associations to the sounds. In this way a warm-up process is employed in Sounds and Images. Interscorer reliability coefficients range from .88 to .97 with an average of .95. Split-half reliability coefficients range from .91 to .77. Alternate form reliability over an interval of 7 days has been reported as being .77. Validity was measured in a variety of ways, such as use of personality, biographical, and attitude inventories, as well as alternate forms and the Torrance Tests of Creative Thinking (Torrance, 1974). Complete information on reliability, validity, and other data can be found in the norms-technical manual (Khatena & Torrance, 1973).

Onomatopoeia and Images (OI), the other independent test of TCSW, also is a measure of originality which presents the subject with 10 onomatopoeiaic words, such as crackel, four times with the same warm-up process as Sounds and Images. OI has two forms and has interscorer reliability cofficients ranging from .95 to .99. Alternative form reliability cofficients for the adult level forms (IIA and IIB) range from .76 to .91 with a combined alternate form reliability of .86. Combined split-half reliability cofficients corrected by the Spearman-Brown formula for form IIA was .70. Construct validity was evaluated with the Runner (Runner & Runner, 1965) studies of attitude patterns (Khatena & Torrance, 1973). Criterion-related validity of OI was measured with Product Improvement and Unusual Uses of Tin Cans

(Torrance, 1974), with the RAT (Mednick, 1959), with the Goodenough-Harris Draw a Man test (Harris, 1963), with Raven's Progressive Matrices (Raven, 1965), with the Torrance Tests of Creative Thinking (Torrance, 1974), with the Scholastic Aptitude Test, with SAM and What Kind of Person Are You? (Khatena & Torrance, 1976), and with the Biographical Inventory-Creative Adolescents (Anastasi & Schaefer, 1969). Complete data on reliability, validity, and other data can be found in the norms-technical manual (Khatena & Torrance, 1973).

Results and Discussion

The means of Sounds and Images for the training group were 32.4 (*SD* = 5.4) and 31.9 (*SD* = 6.3) for the no training condition. Results of the analysis of variance (ANOVA) for Sounds and Images indicates no significant main effects for training conditions, *F* (1, 108) = .20, *p* = .66.

The means of Onomatopoeia and Images for the no training group were 80.3 (*SD* = 19.8) and 75.7 (*SD* = 19.4) for the training group. Results of the ANOVA for Onomatopoeia and Images indicated there were no significant main effects for the training conditions, *F* (1, 108) = 1.46, *p* = .23.

A predominant idea in education and psychology is that spaced practice is superior to massed practice in learning and memory (Gartman & Johnson, 1972; Glenberg, 1976; Hintzman, 1969; Magigan, 1969). Past research which used the same five creative thinking strategies and posttests (Khatena, 1970, 1971a, 1973) gave all training on consecutive days and the posttesting immediately after completion of the training. This method of training and immediate posttesting may have accounted in great part for the significant results. When the training was spread out over 2 weeks and testing was 1 week after that, no

significant differences were found. The lack of significant treatment effects found in this study may be due to these differences. Training immediately before testing probably produced a warm-up effect. Attempts to improve creative thinking by stimulating the creative imagination may need a very intensive training program similar to that used in the past. This may be because individuals have developed characteristic ways of thinking which may tend not to be highly creative. To alter these patterns intensive training may be necessary. In this study there may have been too much time between training sessions or too little training to accomplish this goal. Even though the subjects may have learned some of the techniques, during the time between the sessions (1 week) they may have returned to less original ways of thinking. That is, the subjects in the training group had on the average 20 years of thinking in their characteristic ways. Then they were exposed to 4 hours of training spread over 2 weeks. It is probable that the subjects went back to their previous style of thinking. A second possible explanation for the nonsignificant results may be that they may have changed their thinking briefly, but returned to less productive thinking during the week between the last training session and the posttest.

Conclusions

Results of this study lead to two conclusions. Attempts to produce significant effects of training to use the creative imagination should be massed, not spaced or of longer duration. To produce significant improvement in the use of the creative imagination through practice, training should be intensive on successive days. Training that has large periods of time between sessions may not allow for maximum acquisition of the skills used to

produce original verbal responses. This knowledge should be used to advise teachers and workshop leaders to avoid training to use the creative imagination that is spaced. This is important information because teachers and trainers often must comply with an organization's time schedule and these schedules may require the use of spaced training.

Further research can be completed in two areas.

1. A study to evaluate massed versus spaced training in creative imagination could be completed. This is appropriate in the light of significant differences between treatment and control groups in creativity in past studies using a consecutive training and posttesting design and the lack of significant differences between treatment and control groups in this study.

2. Research on the long and short-term effects of training in creative imagination could be undertaken. This should be completed because although ample data suggests short-term improvement in creativity, to date no study has evaluated the long-term effects of training to use the creative imagination.

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